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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/990,049	11/21/2001	William Ford	450117-03449	1484

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EXAMINER	
NAFF, DAVID M	

ART UNIT	PAPER NUMBER
1651	

DATE MAILED: 09/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/990,049	FORD ET AL.	
	Examiner	Art Unit	
	David M. Naff	1651	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 June 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *25-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *25-47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

The amendment of 6/14/04 amended claims 25-31, 33-39, 41 and 46.

Claims examined on the merits are 25-47, which are all claims in the application.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

Claims 25-47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 25, line 10-11, and where required in other claims, the meaning and scope of "binding of said nucleic acid specific metal complex through an interactive ligand" is uncertain as to process steps required to bind through an interactive ligand, and how binding with a ligand relates to specific metalation of bases. The claim does not require a ligand, and it is uncertain how ligand binding can occur when no ligand has been previously required to be present. The use of a ligand appears to be a separate process from metalation of bases of the nucleic acid, and would require different steps than set forth by claim 25.

Claim 40 is unclear for the same type of reasons as claim 25 in requiring interactive ligand binding as an alternative to metalation of bases of the nucleic acid. Additionally, by reciting "and/or" the claim encompasses formation of the conjugate by both metalation of

bases and ligand binding together. It is not seen how both can occur together.

Bridging lines 1 and 2 of claim 26, "the nucleic acid component is reacted dissolved" is uncertain as to meaning. Additionally, there is not clear antecedent basis for "the nucleic acid component", and it is unclear where in the steps of claim 25 a nucleic acid component has the forms of claim 26.

Claim 36 is unclear by not having clear antecedent basis for "the metal complex-nucleic acid composite". This term is not recited in claim 35 or claim 25. Claim 25 recites "metal complex-nucleic acid conjugate" and "metal nanoparticle-nucleic acid composite", and claim 35 recites "metal nanoparticle-nucleic acid composite". Claim 36 is further unclear as to the meaning of "composite is treated dissolved" in line 2, and it is unclear as to where in the steps of claims 25 and 35 a composite as required by claim 36 has forms as required by claim 36.

Claim 41 is unclear by reciting "said nanowire is completely metallised or not completely metallised". The meaning and scope of this limitation is uncertain. Being "complete" is relative and subjective. Additionally, there is not antecedent basis in claim 40 on which claim 41 depends for complete and not complete metallisation.

Response to Arguments

Applicants urge that amendments to the claims render the rejection moot. While amendments have rendered parts of the rejection moot, other parts of the rejection have not been rendered moot, and

some of the amendments have created additional indefiniteness for reasons set forth above.

Claim Rejections - 35 USC § 103

Claims 25-31 and 33-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pompe et al (AR) in view of Singh et al (5,560,960) and Richter et al (AQ).

The claims are drawn to a process of producing a metal nanoparticle-nucleic composite by reacting a nucleic acid with a metal complex to produce a metal complex-nucleic acid conjugate by metalation of bases and/or interactive ligand binding, removing non-conjugated byproducts, and reacting the conjugate with a reducing agent to produce the metal nanoparticle-nucleic acid composite. The metal nanoparticle of the composite is catalytically active towards electroless metallisation. Also claimed is a metal nanoparticle-nucleic acid composite resulting from the process, a process of making a nanowire by treating the composite by electroless deposition of metal, a nanowire resulting from the process, and a network or electronic circuit containing the nanowire.

Pompe et al disclose (page 1090, left col, second full paragraph) that Pt(II) and Pd(II) complexes such as cis-diamminedichloroplatinum attach to DNA bases to form stable monofunctional and bifunctional adducts. Further disclosed (third full paragraph of the left col) is that the Pt-DNA bond is not broken during reduction, and that Pt(II) and Pd(II) complexes attached to DNA double chain can act as nucleation centers for the growth of metal clusters. Also disclosed

is carrying out metallization of DNA by adding DNA to Pd salt solution followed by adding a reducing agent, and obtaining clusters on the DNA of 3 to 5 nm in diameter in a few seconds after adding the reducing agent (paragraph bridging the cols, page 1090).

Singh et al disclose (paragraph bridging cols 1 and 2) precipitating nanometer-sized metal particles from solution within vesicles made from polymerizable phospholipids. Polymerized phospholipids are formed and added to a electroless plating solution. Before the electroless plating solution is added, palladium or platinum is provided on the inside surface of vesicles to function as a catalyst (col 3, lines 44-64). To insure that metal particles form only on the inside surface, any metal on the exterior surface of the vesicle is removed such as by using a chelating agent and gel filtering, or by passing the vesicles through an ion exchange column. Singh et al further disclose (col 5, line 18) using cobalt, nickel or iron when producing metal nanoparticles by electroless plating.

Richter et al disclose (page 508 and 510) metallization of DNA similar to Pompe et al and disclose formation of clusters of 1-5 nm diameter on DNA (page 508, left col, third full paragraph).

It would have been obvious to attach cis-diamminedichloroplatinum to DNA as disclosed by Pompe et al, and then use a reducing agent to obtain DNA containing attached platinum metal catalysis for use in electroless deposition of metal on the DNA as suggested by Singh et al subjecting vesicles containing Pd or Pt to electroless metal deposition and as suggested by Pompe et al carrying out metallization

of DNA by treating a DNA solution with a Pd salt solution, and then adding a reducing agent to form metal clusters on the DNA. Removing non-attached metal complex from the DNA before electroless metallization would have been obvious to prevent the non-attached metal complex from forming metal particles as suggested by Singh et al removing metal from the exterior of vesicles to prevent metal particles from being formed on the vesicles exterior surface. The objective of Pompe et al is to obtain metal clusters on the DNA and not at other places, and to accomplish this one would obviously have to remove none attached metal complex before electroless metallization. It would have been apparent form Richter et al that metal clusters of 1-5 nm diameter can be obtained, and it would have been obvious to produce clusters not thicker than DNA since this is an objective of Pompe et al (page 1090, left col, first full paragraph). Reacting DNA with cis-diamminedichloroplatinum as disclosed by Pompe et al followed by reducing as set forth above will inherently result in metallization of bases, and provide a metal nanoparticle active towards electroless metallization. When carrying out metallization of DNA as set forth above, it would have been obvious to form a nanowire since Pompe et al (page 1090, right col, lines 1-10) and Richter et al (paragraph bridging pages 508 and 509) obtain a nanowire. Using the nanowire in an electronic circuit would have been obvious since metal wires are conventionally used in such circuits. The metallization of Pompe et al and Richter et al is controlled since they disclose controlling the time of metallization to control the size of clusters.

The use of cobalt, nickel or iron when producing metal nanoparticles by electroless plating as disclosed by Singh et al would have suggested using a electroless plating solution as in claim 38.

Response to Arguments

Applicants point out that a feature of the invention is the initial direct binding of a metal complex to the nucleic acid, and this feature is not suggested by the references. However, as noted above, Pompe et al disclose binding cis-diamminedichloroplatinum to DNA, and suggest that metal of the resulting conjugate can act as a nucleation center for the growth of metal clusters.

Applicants point out that the present invention binds the metal complex to DNA before reducing it, and this distinguishes the invention from Pompe et al. However, Pompe et al intend to contact the metal complex with the DNA before reducing since Pompe et al disclose metallization by adding a metal salt to DNA in a first step and then reducing in a second step (page 1090, left col, 4th complete paragraph). Additionally, Pompe et al disclose that the Pt-DNA bond is not broken by a reduction process (page 1090, left col, 3rd complete paragraph). Pompe et al would not have been concerned about breaking the bond by reduction if reduction is not carried out after the nucleic acid is contacted with the metal complex.

Applicants urge that Richter et al produce nanoparticles substantially wider than DNA. However, the clusters of Richter et al can be 1-5 nm in width. The width of DNA is 2 nm. An objective of Pompe et al is to obtain more finer and more homogeneous metallization

to improve wire conductivity and keep it not thicker than nonmetallized DNA (page 1090, left col, first full paragraph). Additionally, in claim 34 the metal nanoparticle size is smaller than 3 nm. Slightly less than 3 nm is wider than 2 nm DNA, and is not significantly different from 3 nm disclosed by Pompe et al and Richter et al.

Applicants urge that separating non-conjugated metal complex unexpectedly produces smaller metal nanoparticle clusters that are more stable and have a larger surface energy. However, the claims do not require obtaining a smaller metal nanoparticle size than can be obtained as suggested by Pompe et al and Richter et al. Separating byproducts as claimed does not have to function to produce smaller clusters and a larger surface energy. It would have been obvious to separate un-reacted metal complex in Pompe et al to prevent the non-attached metal complex from forming metal particles as suggested by Singh et al. Additionally, separating un-reacted reactants would have been obvious to prevent the un-reacted reactants from interfering with subsequent steps of reacting. The clusters of Richter et al do not have to be 3-5 nm, but can be 1-5 nm, which encompasses sizes smaller than 3 nm. Moreover, claim 34 encompasses a size slightly less than 3 nm, and this size is not significantly different from 3 nm disclosed by Pompe et al and Richter et al. As to the clusters of Pompe et al being based on ionic interaction as urged by applicants, the present claims do not exclude ionic interaction to form clusters.

Claim Rejections - 35 USC § 103

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 25-31 and 33-47 above, and further in view of Newsman et al (5,670,680).

The claim requires a gaseous reducing agent.

Singh et al disclose using hydrogenation (col 4, line 57) for reducing metal ions to produce metals in a process of producing metal nanoparticles by electroless plating.

Newman et al disclose using hydrogen gas for hydrogenation in producing metal complexes.

It would have been obvious to use hydrogen gas as a reducing agent to reduce the metal of a conjugate of a metal complex and DNA disclosed by Pompe et al as suggested by Singh et al and Newman et al.

Response to Amendment

This rejection has not been separately traversed.

Double Patenting

Claims 25-47 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-22 and 24-35 of copending Application No. 10/210,812 in view of Singh et al.

The claims of the copending application require metallization of a nucleic acid to produce a metal nanoparticle-nucleic acid composite.

It would have been obvious in view of Singh et al for the type of reasons set forth above to remove unattached metal complex before treatment with a reducing agent in the process of the copending

application claims for metallization of DNA. The presence of extraneous metal complex will obviously be a contaminant that can interfere with subsequent reactions.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments

Applicants' urge that the copending application claims do not remove non-conjugated metal complex, and there is not motivation in the '812 application claims to combine its teachings with Singh et al. However, the removal of metal complex other than at a desired site for depositing metal is suggested by Singh et al, and the reason for removing this extraneous metal complex provided by Singh et al is motivation.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be

calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David M. Naff whose telephone number is 571-272-0920. The examiner can normally be reached on Monday-Friday 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mike Wityshyn can be reached on 571-272-0926. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David M. Naff
Primary Examiner
Art Unit 1651

DMN
9/7/04